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Conrad R. Lam

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Rationale and results of anatomic repair of esophageal hiatus hernia*

Conrad R. Lam, M.D.**

A logical method of repair of esophageal hiatus hernia based on anatomic principles was proposed nearly 25 years ago by the late Phillip Allison. There was general agreement that his operation had advantages, but because of a disappointing number of recurrences and problems with reflux, more complicated operations were devised. Some of these involved plication of the stomach around the lower esophagus (Nissen, Belsey). In a series of 562 operations for hiatus hernia at the Henry Ford Hospital, there has been no significant deviation from the Allison technic. Complicating lower esophageal rings (Schatzki) have been excised. There has been no example of a short esophagus which prevented placement of the stomach below the diaphragm. Residual reflux has not been a problem and the recurrence rate has been low (5%).

A logical method for the repair of esophageal hiatus hernia based on anatomic principles was proposed nearly 25 years ago by the late Philip Allison, then of Leeds and later of Oxford, England, in his paper titled "Reflux Esophagitis, Sliding Hernia and the Anatomy of Repair."[1] He correctly stressed the fact that reflux esophagitis is a complication of sliding hernia and not paraesophageal hernia, for which he coined the term "rolling hernia." There were two significant steps in his "anatomy of repair," (1) the fixation of the phrenoesophageal ligament to the under surface of the diaphragm with restoration of the oblique angle of entry of the esophagus into the stomach (Figure 1), and (2) posterior approximation of the crural fibers (Figure 2). He used the transthoracic approach, although admittedly his two objectives can be attained by a transabdominal approach, as has been done with much success by Hill.[2]

Although initially there was general agreement that the Allison repair was a good one, some surgeons noted a disappointing number of recurrences and problems with persistent gastroesophageal reflux. As a result, there has been a considerable turning away from a basically anatomic repair and a trial of more complicated procedures aimed at the creation of a physiologic valve mecha-

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** Consultant, Division of Thoracic and Cardiac Surgery.

Address reprint requests to Dr. Lam at Henry Ford Hospital, 2799 West Grand Boulevard, Detroit, MI 48202.

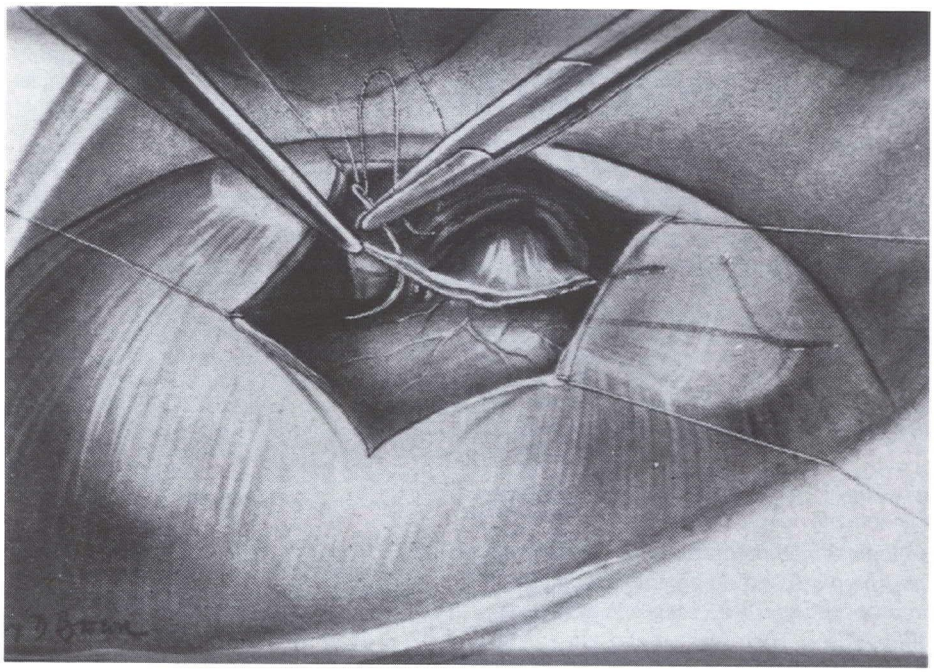

Figure 1
Drawing from Allison's paper showing attachment of phrenoesophageal ligament to the under surface of the diaphragm through a diaphragmatic incision. (Courtesy of *Surgery, Gynecology and Obstetrics*).

nism by partial or complete wrapping of the stomach around the lower end of the esophagus. In the operation recommended by Ronald Belsey and his associates,[3] a fold of the fundus of the stomach is sutured to the anterior two-thirds of the esophagus, through a transthoracic approach. In the operation of Rudolph Nissen,[4] the lower end of the esophagus is completely encircled by the fold of stomach. His preference is for the transabdominal approach. If the simpler "anatomic" repair is to be abandoned in favor of those more complicated technics, it must be established that the latter show a considerable advantage with long-term follow-up. I have followed with interest the results of those doing the fundoplication operations, but I have continued to rely on the anatomic repair, basically the technic of Allison.

The Henry Ford Hospital series consists of 577 operations on 562 patients, done between the years 1947 and 1974. Special follow-up investigations were made in 345 patients operated on before 1967. 279 of these (80%) were classified as having sliding hernias; 60 (18%) had paraesophageal or rolling hernias, and 6 (2%) were assigned to a new category which has been called "infracardiac bursa hernia" (Figure 3). A complete discussion of the reasons for the addition of this new classification can be found elsewhere.[5] The infracardiac bursa hernias are differentiated from other paraesophageal hernias because they enter the chest through an opening to the right of the esophagus (the pneumato-enteric recess or infracardiac bursa), and invariably come to lie in the right pleural cavity. The technic of the repair of this type of hernia differs considerably from that of the more common types; some may require an intraabdominal approach.

The technic of repair of sliding and para-

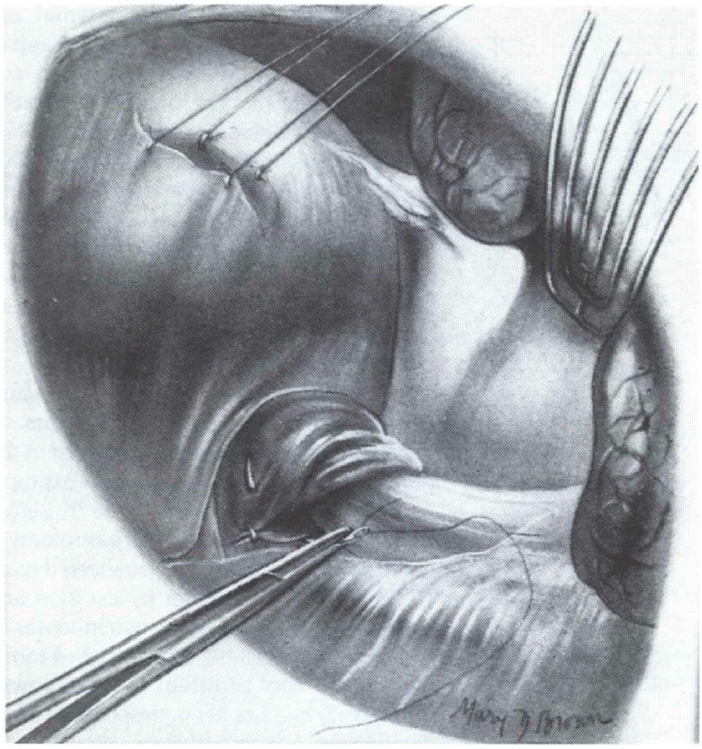

Figure 2
Allison's method of approximation of crural fibers posteriorly. (Reproduced through courtesy of *Surgery, Gynecology and Obstetrics*).

esophageal hernias which has been used in this series differs only in certain details from that originally described by Allison. The objective is replacement of the esophagogastric junction to a position below the diaphragm, but it is not assumed that a considerable length of esophagus in the intraabdominal position is either normal or desirable. It is thought that the phrenoesophageal ligament is an important structure which should be utilized in the repair of hiatus hernia (Figure 4). There have been few anatomic studies of this ligament. One was by Bombeck, Dillard and Nyhus[6] of the University of Washington who not only found the phrenoesophageal ligament in every instance in a study of 227 autopsies, but concluded that the level of its insertion on the esophagus appeared to have an effect on the competence of the lower esophageal sphincter mechanism. They suggested that an operation which applies circumferential tension around the insertion of the phrenoesophageal ligament not only may not cure the reflux, but may aggravate it.

Because of the large number of dehiscences which have been reported, there is a disagreement about the advisability of making the so-called "counter-incision" in the diaphragm which Allison used for the suturing of the phrenoesophageal ligament to the under surface of the diaphragm (Figure 1). I have continued to use it in spite of occasional dehiscences, in the belief that it should be possible to close such a simple incision securely. The method of closure which was evolved involves a double suture line with "throws" on each knot of the silk suture (Figure 5). The multiple "throws" are desirable because when repairing the dehiscences, we found that the sutures had become untied rather than broken. My associate, Dr. Thomas Gahagan, used a special double-needle holder for passing the sutures under the diaphragm (Figure 6). The final

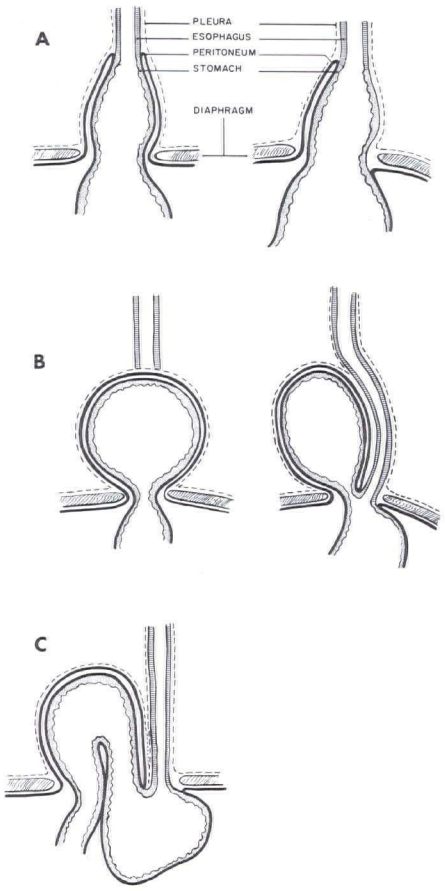

Figure 3

Diagrams of three types of esophageal hiatal hernia. Figures on the left are frontal views; those on the right are lateral views. A, sliding hernia. B, paraesophageal or rolling hernia. C, infracardiac bursa hernia. (This figure and figures 4-7 are from Gahagan T and Lam CR: *Esophageal Hiatus Hernia: Rationale and Results of Anatomic Repair,* reproduced by courtesy of Charles Thomas, Publisher, Springfield, IL, 1976.)

step in the repair of the hiatus is the approximation of its margins (crural fibers) posteriorly (Figure 7). It is preferable to tie these sutures before the phrenoesophageal ligament sutures are tied, leaving a finger in the hiatus to prevent an overly tight closure of the hiatus (Figure 8).

Several lesions of the esophagus may add to the symptoms and complicate the repair of sliding hiatal hernia. Because the esophagus is a thoracic organ, these problems are dealt with more conveniently when a transthoracic rather than a transabdominal approach is chosen for the operation. These lesions are the lower esophageal ring (Schatzki), esophageal stricture, the so-called "short esophagus" and the esophagus lined in part by columnar epithelium (Barrett).

In this series of 562 patients with hiatus hernia, 21 (nearly 4%) had a symptomatic Schatzki's ring. These were corrected at the time the hernias were repaired. An example of such a ring is shown in Figure 9. Before reduction of the hernia, a small gastrotomy is made and the ring is easily visualized (Figure 10). It is eliminated either by excision and suture approximation of the two mucosas or by a plastic procedure involving 3 or 4 radial incisions. The problem of the lower esophageal ring has been presented in more detail in a previous communication.[7]

For the strictures due to long-standing reflux esophagitis, the method of Hayward of Australia[8] has been utilized. At the time of the repair of the hernia, there is vigorous dilatation of the stricture with the finger and instruments introduced through a gastrotomy, after which the hernia is repaired. Additional peroral dilatations are done postoperatively as indicated. Thus, resection of the strictured portion of esophagus and its replacement by colon or a tube of stomach have been avoided.

Much has been said about the "short esophagus" which might make replacement of the stomach into the abdomen impossible. It has been found that with adequate mobilization of the "shortened" esophagus, to the arch of the aorta if necessary, sufficient length of the esophagus is invariably available.[9]

An example of an apparently short esophagus is shown in Figure 11. The

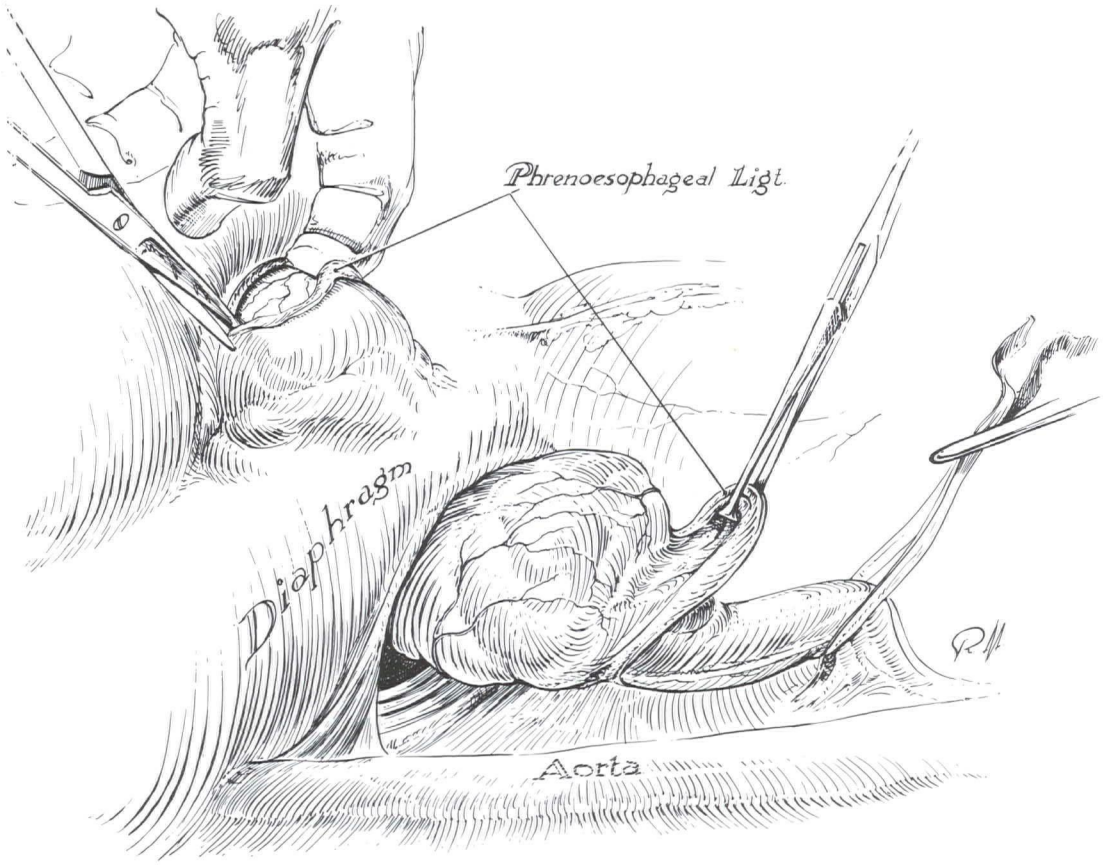

Figure 4
A step in the repair of sliding hiatus hernia: division of the phrenoesophageal ligament anteriorly (opening the peritoneal sac).

esophagogastric junction is identified by a thick Schatzki's ring which was causing dysphagia. When the esophageal hiatus hernia was repaired after a plastic procedure on the ring through a gastrotomy, the esophagogastric junction was easily brought below the diaphragm. The patient was asymptomatic a year later.

Results

Since the mortaility associated with the repair of esophageal hiatus hernia should be and has been low, reports of results have been concerned mainly with the problems of recurrence and persistant esophagogastric reflux. The results of the "anatomic" repair will be compared with the results obtained by surgeons doing fundoplication operations or other complicated repairs. In 1966, Skinner and Belsey[3] reported a series of consecutive operations on 1,030 patients at the Frenchay Hospital of Bristol. The "Mark IV" fundoplication operation had been used in 632 patients between the years 1955 and 1962. The follow-up on these cases showed that symptomatic recurrences had occurred

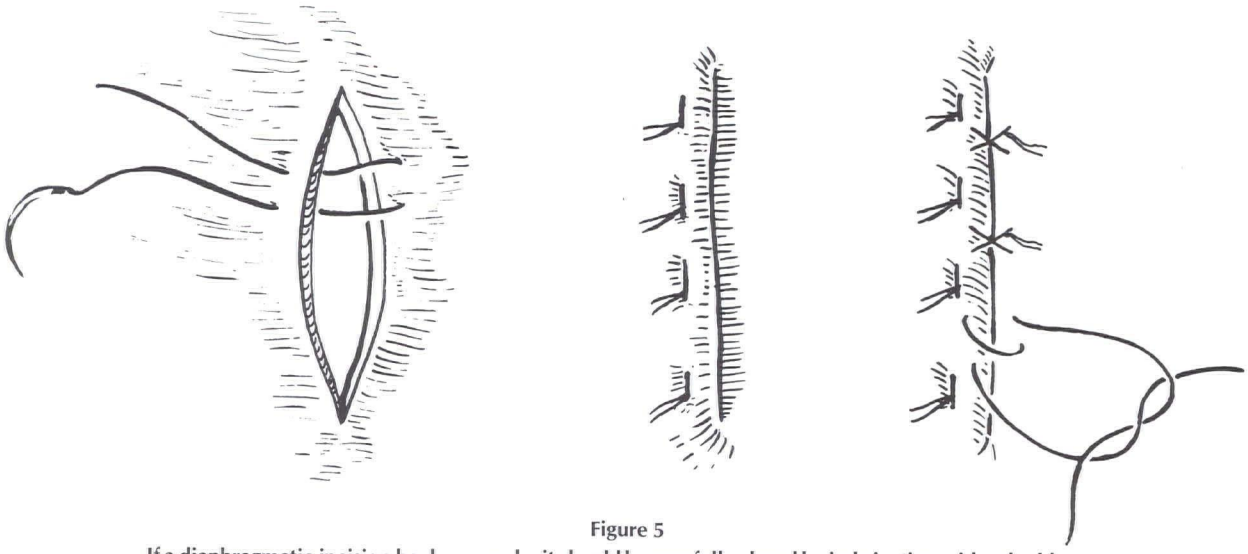

Figure 5
If a diaphragmatic incision has been made, it should be carefully closed by imbrication with a double row of sutures.

Figure 6
Mattress sutures fix the phrenoesophageal ligament to the under surface of the diaphragm.

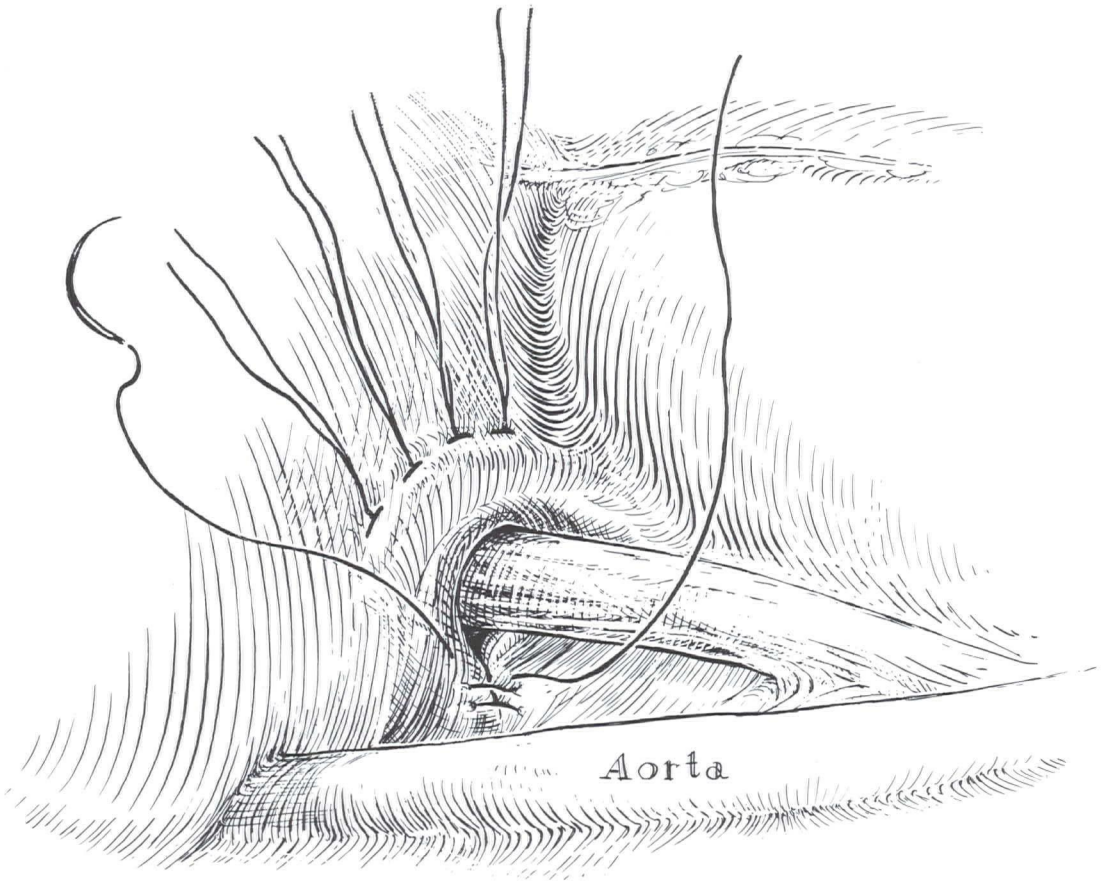

Figure 7
Reduction in size of hiatus by posterior crural sutures.

in 5.6% of the cases, as compared with 16% in cases operated on by other technics in the years 1949-1955. Five years later, a progress report by Belsey's group[10] gave the overall recurrence rate as 11% . The recurrence rate in patients followed 3-10 years was 12% . It was 14.7% in patients followed more than 10 years. The authors seemed to be of the opinion that the recurrence rate was not excessive, because they stated "Long-term evaluation of the Mark IV hiatal hernia repair has demonstrated the value of this procedure in treating gastroesophageal reflux and its complications." One of the discussants of the paper at the meeting of the American Association for Thoracic Surgery was Urschel of Dallas, who had favored the Mark IV operation five years before.[11] He said that because of some unsatisfactory results with the Belsey technic in certain cases, he was resorting to Collis gastroplasty operation.[12]

The next year, Urschel[13] gave a formal report for his group, saying that although valve reconstruction procedures at the esophagogastric junction give relief to most patients with hiatal hernia and reflux, there had been a recurrence rate of 10% to 15%.

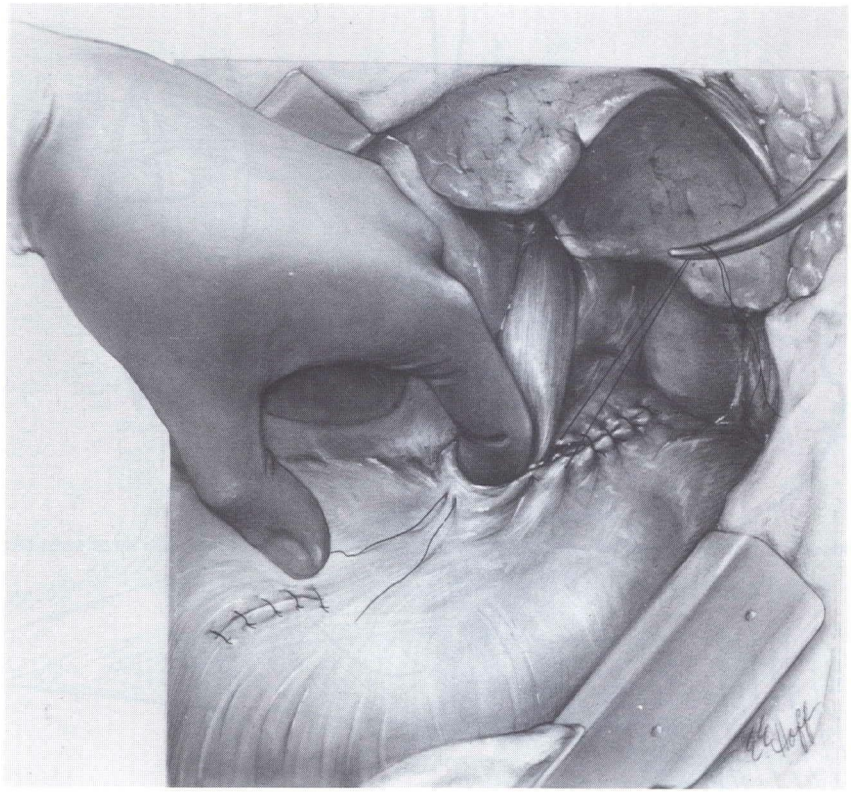

Figure 8
The last crural suture is tied with a finger in the hiatus to prevent too tight closure. (From Lam CR and Kenney L, *J Thoracic Surg* 27:1, 1954, by permission of C. V. Mosby Co.)

They thought that the primary cause of failure was tension on the esophagus which was produced from "securing an adequate length of intraabdominal esophagus." They sought to solve this problem by performing the Collis gastroplasty which lengthens the esophagus by the construction of a tube of the lesser curvature of the stomach, combined with a Belsey reconstruction of the angle. This operation had been done in 39 patients with no reported evidence of reflux or recurrence. The Dallas group appeared to be getting better results with Collis operation than Collis himself, who in 1961[14] stated "Barium swallow at the end of one year showed that the control of reflux is not nearly as good as that effected in hiatus hernia without short esophagus using my own operation. Some reflux could be produced in practically all cases by determined efforts ..." Incidentally, the feature in his "own" operation is the suturing of the crural fibers above the anterior to the esophagus rather than postero-inferiorly as in the Allison repair. Presumably the better results obtained by Urschel could be explained by the addition of fundoplication to the gastroplasty.

Results of the series at Henry Ford Hospital

An intensive follow-up of operations done before 1963 was carried out in 1966-67. The results are summarized in Table I. This indicates a continued improvement in long-term

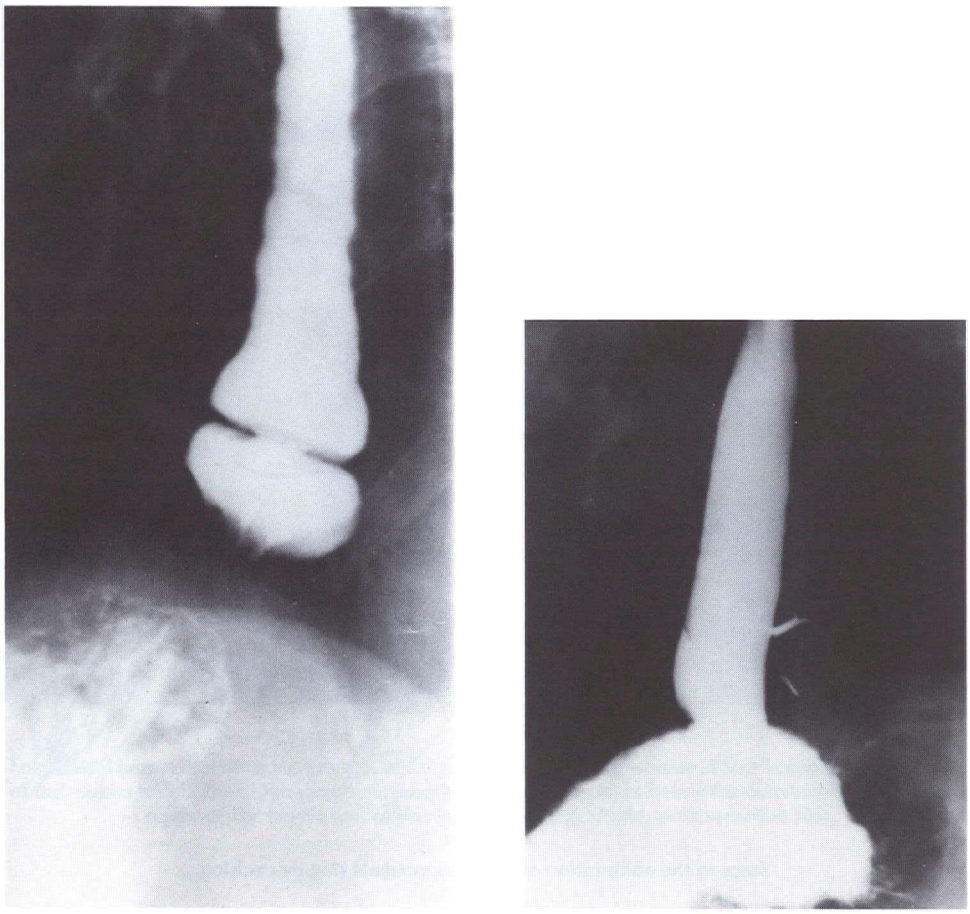

Figure 9

Left, lower esophageal ring (Schatzki) in a 58-year-old man with dysphagia. Right, film after excision of the ring through a gastrotomy and repair of the hiatus hernia. (See following figure).

results with more rigid following of the technic of Allison, which involved more attention to fixation of the phrenoesophageal ligament. The recurrence rate in 160 cases repaired by this technic was 6%. Symptomatic gastroesophageal reflux was not a problem in the absence of radiologic recurrence.

Since 1962, an additional 224 "Allison" repairs have been done. There are no known additional recurrences, although admittedly there has been no systematic follow-up.

Discussion

The swing of the pendulum back to the basic anatomic repair of Allison was illustrated by the paper of Kaunitz and his associates in their paper[15] before the American Association for Thoracic Surgery in 1974. They expressed dissatisfaction with the fundoplication operations, saying that failures are probably due to the sutures pulling out of the weak esophageal muscle. They recommended "reposition of the lower esophageal sphincter" by six sutures "deep in the gastric wall, within 1 cm of the gastroesophageal

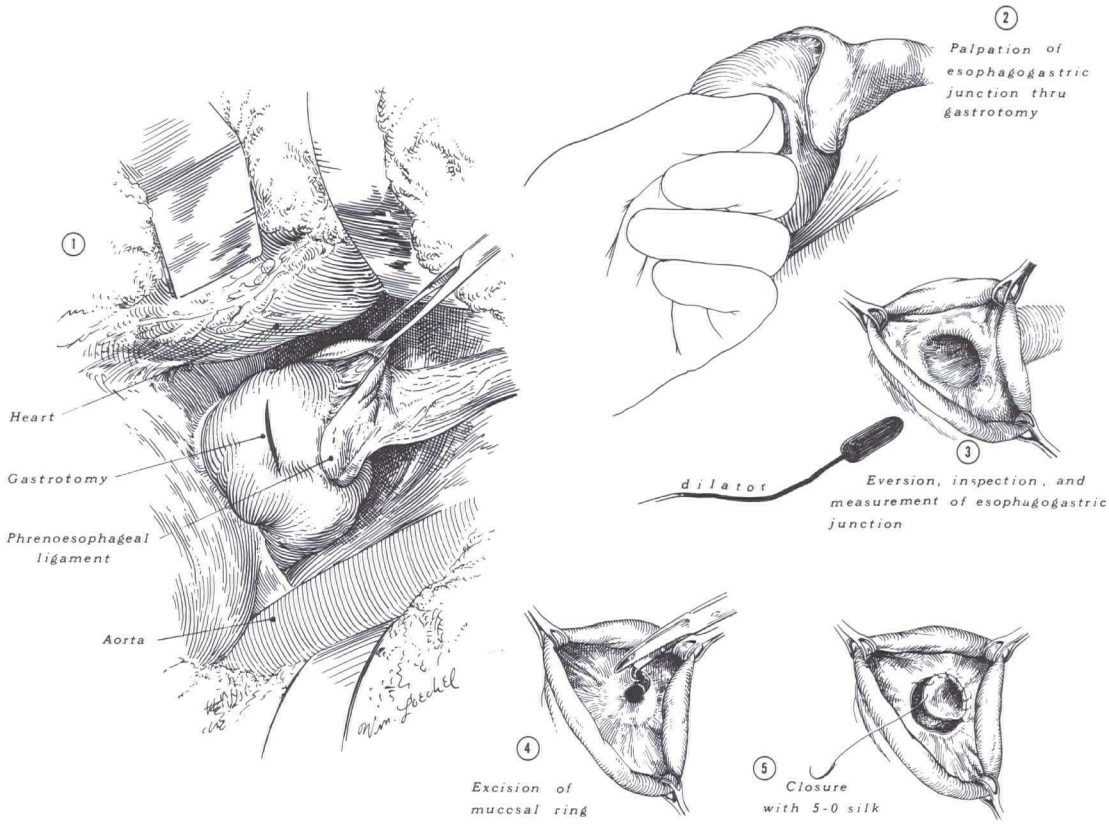

Figure 10
Steps in the obliteration of lower esophageal ring by excision.

junction," the ends of which are passed through the diaphragm from peritoneal to pleural surfaces 4 to 6 cm from the hiatus. In discussion of the paper, Strieder[16] said "The simpler the operation, the better. A hiatal hernia repair has only three principles, as for any hernia: (1) to eliminate the sac; (2) to reduce the viscus, and (3) as emphasized by Dr. Kaunitz, to make sure that the cardioesophageal junction becomes abdominal."

Conclusion

It is believed that repair of esophageal hiatus hernias by a technic based on restoration of the normal anatomy will give results which are satisfactory. Operations which involve distortion of the normal anatomy, such as those involving fundoplication and/or gastroplasty do not appear to be necessary for the achievement of this goal.

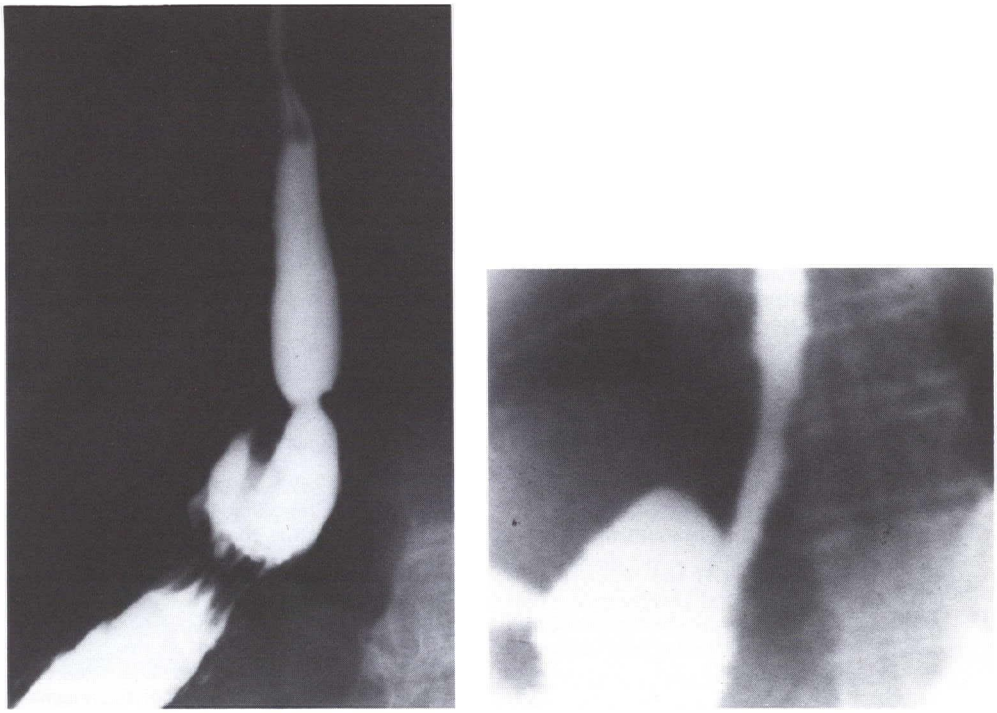

Figure 11

Left, Hiatal hernia and thick lower esophageal ring in a 71-year-old woman. There is apparent shortening of the esophagus but the esophagogastric junction was easily brought below the diaphragm at the time of repair of the hernia and obliteration of the ring. Right, postoperative film.

TABLE 1

358 HIATUS HERNIA REPAIRS IN 348 PATIENTS, THROUGH 1962

	Operations	Recurrences	Per cent
Group I			
Plication or excision of sac and various crural sutures	19	11	58
Group II			
Posterior crural sutures	179	30	16
Group III			
Posterior crural suture and phrenoesophageal ligament fixation	160	10	6

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